STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

DESIGN REQUIREMENTS

May 25, 2005

PREFACE

In order for the Division of Facilities Construction and Management (DFCM) to be one of the nation's premier facility managers, it is essential that we consistently improve our performance. In order to do this, the Design Requirements provides a document and review process for consistently improving our processes and standards.

DESIGN REQUIREMENTS

TABLE OF CONTENTS

Preface
Table of Contents

1.0 GENERAL
- 1.1 General
- 1.2 Procedure
- 1.3 Hierarchy of Requirements
- 1.4 Changes and Additions to Design Requirements

2.0 CODES / LAWS / RULES AND REGULATORY REQUIREMENTS
- 2.1 DFCM Requirements Include
- 2.2 Building Code Commission
- 2.3 Fire Prevention Board
- 2.4 Accessibility Code
- 2.5 Labor-Industrial Commission
- 2.6 Department of Health
- 2.7 Department of Environmental Quality
- 2.8 County Health Department
- 2.9 Department of Commerce

3.0 DFCM REQUIREMENTS

3.1 GENERAL
- A. Distributed Live Loads
- B. Energy Conservation Requirements
- C. Enhanced Accessibility
- D. Sustainable Design
- E. Hazardous Materials
- F. Vibration
- G. Utah Space Standards
- H. Infrastructure Flexibility

3.2 CIVIL
- A. Paving

3.3 ARCHITECTURAL
- A. Suspended Ceiling Systems
- B. Daylight and Outside Views
- C. New Roofing Requirements
- D. Replacement Roofing Requirements

E. Waterproofing and Sealants
F. Acoustical Quality
G. Guardrails

3.4 STRUCTURAL

A. Concrete

3.5 MECHANICAL

A. Controllability of Systems
B. Indoor Air Quality
C. Plumbing General Requirements
D. Water System
E. Waste System
F. Plumbing Fixtures and Equipment
G. HVAC General
H. Air Distribution
I. Piping System
J. Steam
K. Natural Gas
L. HVAC Equipment
M. Integrated Automation
N. Automatic Sprinkler Systems

3.6 ELECTRICAL

A. Emergency Electrical Requirements
B. Lighting
C. Raceways for 600 V
D. Conductors
E. Grounding
F. Medium Voltage
G. Controller
H. Electrical Distribution
I. Miscellaneous Electrical
J. Structured Cabling
K. Fire Alarm
L. Misc Systems

3.7 LANDSCAPING

A. Irrigation Water
B. Plant and Soil

DESIGN REQUIREMENTS

1.0 GENERAL

1.1 General

A. These Design Requirements apply to all plans, processes, and procedures required for compliance with the Design Process.

1.2 Procedure

A. Complete the Design Requirement/Variance Form to make recommendations for additions, deletions, and changes to the Design Requirements.

B. Complete the Design Requirement/Variance Form to request approval by the Director to vary from these Design Requirements based upon the specific project needs.

C. All Design Requirement modifications require approval by the Director.

1. If the Design Requirement is approved by the Director, then the DFCM's Designated Representative shall distribute the Design Requirements Procedure document to the appropriate project participants and shall file it in the project file.

2. If the Design Requirement is approved by the Director and has general applicability to other projects, the Director shall arrange for the Design Requirement modification to be added to the appropriate document.

    a. Verify with the DFCM person responsible for the specific professional discipline and the appropriate DFCM maintenance person that the proposed Design Requirement meets their requirements.

1.3 Hierarchy of Requirements

A. The hierarchy of requirements is as follows:

1. Comply with the minimum requirements of all applicable laws, rules, and regulatory requirements.

    a. Exceptions: Wherever there are practical difficulties involved in carrying out these provisions, the State Building Official with the approval of the Director of DFCM and/or the State Fire Marshall shall have authority to grant modifications. The modifications granted by the State Building Official shall be documented in this standard under the heading "Design Requirements."

2. Comply with the consensus based ANSI standards for design, products, installation, and services unless the applicable laws, rules, and regulatory requirements are more stringent.

3. Comply with the "Performance Requirements: Design Requirements" unless the ANSI standards or the applicable laws, rules, and regulatory requirements are more stringent.

4. Comply with the Contract Documents, unless the "Performance Requirements: Design Requirements", the ANSI standards, or the applicable laws, rules, and regulatory requirements are more stringent.

1.4 Changes and Additions to Design Requirements

Complete the following document and submit it to the person to whom you are responsible to for ultimate decision by the Director, for requested changes/additions to the Design Requirements.

Design Requirement/Variance Change Request

Project Name	**Date**
	DFCM Project Number
	Risk Management Number
Requested by	**Entity**
Brief Description of the Problem	
Design Requirements	
Justification	
Director Approval	**Date**
Action to Include This Design Requirements in the Design Requirements	
Professional Reviewer	**Position**
Maintenance Reviewer	**Position**
Director Approval	**Date**

2.0 CODES / LAWS/ RULES AND REGULATORY REQUIREMENTS

2.1 DFCM requirements include (but are not limited to):

A. Administrative Services: Comply with Title R23: Administrative Services, Facilities Construction and Management. Refer to http://www.rules.utah.gov/publicat/code/r023/r023.htm

B. DFCM Services: Comply with Services requirements. Refer to http://dfcm.utah.gov. Services requirements include:

(1) Inspections and Testing, refer to http://dfcm.utah.gov/inspections/inspections.htm
(2) Standards, refer to http://dfcm.utah.gov/publications/dfcm_standards.htm
(3) Standard Project Documents, refer to http://dfcm.utah.gov/publications/dfcm_standard_project_docs.htm
(4) Roofing, Paving, and Hazardous Materials, refer to http://dfcm.utah.gov/rphm/rphm.htm
(5) Other requirements which may be added after this document is published.

2.2 Building Code Commission

A. Comply with Utah Uniform Building Standards Act. Refer to http://www.dopl.utah.gov/licensing/statutes_and_rules/R156-56.pdf. Enforcement of these codes is the responsibility of the State Building Official.

2.3 Fire Prevention Board

A. Comply with Fire Codes in accordance with "Laws, Rules" of the State Fire Marshall. Refer to http://firemarshal.utah.gov/Laws_Rules/laws_rules.html. Enforcement of these codes is the responsibility of the Utah Fire Marshall.

2.4 Accessibility Code

A. Comply with the US Department of Justice Federal Registers – Americans with Disabilities Act. Refer to http://www.usdoj.gov/crt/ada/adahom1.htm

2.5 Labor-Industrial Commission

A. Comply with requirements of the Labor-Industrial Commission. Refer to http://www.labor.state.ut.us.

(1) Boiler and Pressure Vessel Compliance Manual, Refer to http://www.labor.state.ut.us/Safety_Division/Regulation_Updates/BPVManRev7D.pdf
(2) Utah Occupational Safety and Health, refer to http://www.rules.utah.gov/publicat/code/r614/r614.htm
(3) Elevator Rules: American National Standard Safety Code for Elevators and Escalators, ANSI/ASME A17.1 with amendments administered by Labor-Industrial Commission of Utah, Department of Occupational Safety and Health Elevator Division. Refer to http://www.rules.utah.gov/publicat/code/r616/r616-003.htm

2.6 Department of Health

A. Comply with requirements of Department of Health. Refer to http://www.health.utah.gov.

(1) Health Care Rules, refer to http://health.utah.gov/hflcra
(2) Utah Indoor Clean Air Act, refer to http://www.tobaccofreeutah.org/r392-510.htm

2.7 Department of Environmental Quality

A. Comply with requirements of Department of Environmental Quality. Refer to http://www.deq.utah.gov.

(1) Public Drinking Water Rules, refer to http://drinkingwater.utah.gov/rules.htm
(2) Utah Division of Air Quality: R307-801, Asbestos, refer to http://airquality.utah.gov/HAPS/ASBESTOS/rules/newrules.pdf ; Environmental Protection Agency (EPA): Regulations for Asbestos – Code of Federal Regulations Title 40, Part 61 Subpart M; and Toxic Substances Control Act PART 763 (Updated 1997) – ASBESTOS: OSHA Standards 1910.1001, 1915.1001, and 1926.1101
(3) Underground Storage Tank Act, refer to http://undergroundtanks.utah.gov/ust_rules/r311_rules_9_04.pdf
(4) Air Conservation Act, refer to http://www.rules.utah.gov/publicat/code/r307/r307.htm
(5) Fugitive Dust Plan, Refer to http://www.rules.utah.gov/publicat/code/r307/r307-309.htm
(6) Utah Pollutant Discharge Elimination System, Refer to http://www.rules.utah.gov/publicat/code/r317/r317.htm
(7) Operating Permits of the Division of Air Quality, refer to http://www.rules.utah.gov/publicat/code/r307/r307-415.htm

2.8 County Health Department (for the county where the facility is located)

A. Food Service Sanitation Rules

2.9 Department of Commerce

A. Pipeline Safety, refer http://www.rules.utah.gov/publicat/code/r746/r746-409.htm
B. Qualifications: Refer to the Project Participants heading of this document.

3.0 DFCM REQUIREMENTS

These requirements are enhancements of code requirements that DFCM has initiated for best practices for State owned facilities.

3.1 GENERAL

A. Distributed Live Loads

Design Requirements

Modify IBC Table 1607.1 "Minimum Uniformly Distributed Live Loads and Minimum Concentrated Live Loads" by the following:

Increase the Uniformly Distributed Live Loads to 80 psf for: Office use in Access floor systems; Operating room, laboratories, private rooms, wards in Hospitals; Reading rooms in Libraries; Offices in Office buildings; Classrooms in schools.

Increase the Minimum Concentrated Live Loads to 2500 lbs for: Office use and Computer use for Access floor systems; Operating rooms, laboratories, corridors above the first floor for Hospitals; Reading rooms, Stack rooms, Corridors above first floor in Libraries; Lobbies and first-floor corridors, offices, corridors above first floor in Office Buildings; Classrooms, Corridors above first floor, First floor corridors in Schools.

B. Energy Conservation Requirements

Design Requirements

Design facilities (except residential facilities) to reduce by 10%, or more, the energy cost using current utility rates, as compared to the performance of a reference building prescribed in Appendix G of ASHRAE/IESNA 90.1. Calculate the percentage of energy conservation savings (ECS) by dividing the proposed energy cost budget for the proposed facility (PR) by the reference building (addendum e) cost budget (BL) and subtracting the result from 1 and multiplying by 100 will give the percentage of energy cost savings: % ECS = 100 (1-PR/BL).

In order to achieve these requirements, DFCM requires that the Engineer design in accordance to the requirements of ASHRAE/IESNA 90.1 and not use the exception in Section 701.1 of the International Energy Conservation Code. The DFCM's Designated Representative may authorize exemptions to the 10% energy cost savings requirement for existing buildings so long as the

building complies with the minimum requirements of ASHRAE 90.1 paragraph 4.1.2 and the related subparagraphs. The Director of DFCM may authorize a lower level of energy efficiency when the standard is not achievable due to the unique circumstances of a particular project or the constraints of the project budget.

In order to achieve the most cost effective energy savings, DFCM requires compliance with the minimum requirements set by the mandatory and prescriptive requirements of ASHRAE/IESNA 90.1.

The 10% energy cost savings shall be documented through simulation of both the reference facility and the proposed facility, using the methodology in ASHRAE 90.1 Informative Appendix G and a DOE 2.x energy simulation program. The required schematic design submittal shall include the documented model for the reference building. The required design/development submittal shall include revisions, if necessary, to the documented model for the reference building and a progress model for the proposed building. The required construction documents submittal shall include revisions, if necessary, to the documented model for the reference building and a documented model for the proposed building validating the 10% energy cost savings. In addition, Mandatory and Prescriptive Compliance shall be demonstrated by including the Envelope Compliance Certificate, Mechanical Compliance Certificate, and the Lighting Compliance Certificate from COMchek-EZ for the most current software for ASHRAE 90.1. Alternatively, for LEED projects the LEED validation for 10% energy conservation savings may be substituted.

DFCM wishes to participate, when possible, with Utah Power under their Energy Finance Program.

C. Enhanced Accessibility

Design Requirements

"It is the policy of the Utah State Building Board that, when appropriate for the intended use of the building and achievable within the project budget, the following accessibility enhancements beyond those required by the Americans with Disabilities Act be provided for in state owned buildings and buildings leased by DFCM: (1) powered door openers for the primary entrance designated for use by people with disabilities, and (2) powered door openers for one uni-sex restroom or for one male and one female restroom in the building unless restrooms with a door-less entry are provided. This policy is not intended to limit the use of powered door openers to the standard set forth herein. This policy applies to the construction or major renovation of state-owned facilities and new leases where the entire building is being leased by DFCM. This policy is not intended to create any rights to any third parties.

Determinations that one or both of these enhancements are not appropriate for the intended use of the building or not possible within the project or lease budget shall be made by the Director or his designee. Determinations of whether this enhancement to accessibility is appropriate should consider the potential of access by people with disabilities. The Director may determine that powered door openers are appropriate for the primary entrance while not warranted or not possible within the budget for access to restrooms. The Director may also determine that one or

both of these enhancements are not feasible in (a) the renovation of an existing building due to its design or configuration or (b) in a leased facility due to the nature and circumstances of the lease."

D. Sustainable Design

Design Requirements

Utilize LEED™ as a checklist of opportunities to improve environmental quality and energy efficiency; however, it is DFCM's policy not to apply for LEED™ certification. Make recommendations of which opportunities should be implemented in accordance with budget constraints to the DFCM's Designated Representative. Obtain approval of DFCM's Designated Representative prior to implementing recommendations.

E. Hazardous Materials

Design Requirements

DFCM shall procure a qualified abatement consultant during the Schematic Design phase of the Design stage. The abatement consultant shall survey all renovation and demolition projects for hazardous materials such as asbestos-containing building materials, lead-based paint, mold, universal wastes such as PCBs, CFCs, mercury, household/janitorial cleaning products, identified/unidentified containers of chemicals or products, or any other materials or waste that may be environmentally unsafe.

Prior to the start of a survey by the abatement consultant, the A/E shall provide drawings at the design development phase of the design stage to the abatement consultant with sufficient information to define the building or facility areas affected by the renovation or demolition. The abatement consultant shall coordinate abatement documents with the updated Contract Documents prior to final preparation. The abatement consultant shall prepare a complying and comprehensive hazardous materials survey report identifying and quantifying all hazardous and non-hazardous building materials to include asbestos-containing building materials, lead-based paint, mold and universal wastes that affect the areas of renovation or demolition.

DFCM shall procure a qualified abatement contractor to remove all hazardous materials prior to the beginning of any building demolition or renovation.

F. Vibration

Design Requirements

Design structure in accordance with the following minimum requirements for vibration:

Vibration	
Space Category	Vibration Sensitivity
Laboratories with equipment sensitive to vibration	Comply with manufacturer's requirements for vibration.
Offices, classrooms, and other similar spaces.	There are no vibrations from machines or traffic which are detectable by people.
Common Area spaces.	There is occasional movement in the floor when heavy equipment are moved nearby.
Storage spaces.	There is obvious and annoying movement when people walk by or equipment is being moved nearby.

G. Utah Space Standards

Design Requirements

Comply with the "Utah Space Standards," August 1994. Refer to http://dfcm.utah.gov/publications/publications_files/space_standards.pdf

H. Infrastructure Flexibility

Design Requirements

Interior Shear Walls: Minimize interior shear walls, bearing walls and braced frames which may disrupt future additions or modifications to the facility.

Spare Mechanical Space: Provide 25% spare space in pipe chases and for mechanical equipment (except air handlers).

Main Electrical Room: Locate main electrical room close to transformer and near the center of the load (which is usually located near where central mechanical equipment is located). Locate panelboards in satellite electrical rooms dedicated for electrical equipment and which stack vertically in the facility.

Spare Electrical Capacity: Provide 25% future space for additional overcurrent protection devices in panelboards and switchboards. Provide 25% additional load capacity in addition to the capacity required for continuous loads in panelboards and switchboards.

Communication Rooms: Locate communications rooms so they stack vertically and comply with TIA/EIA standards.

Spare Communication System Capacities: Provide 100% future space (this is not necessarily horizontal space, but may be vertical space in racks for future equipment) for cabling, data, and communications electronic equipment.

Equipment Access: In new facilities, provide access for replacement of equipment which does not require demolition.

Storage Space: Provide a minimum 6' X 6' space for storage of janitorial supplies or .2% of the gross square footage, whichever is greater.

3.2 CIVIL

A. Paving

Design Requirements

Use untreated base course under all curbs and gutters. Use untreated base course material under all sidewalks exterior flatwork and paved areas.

Untreated base course under asphalt paving: Asphalt - 8" minimum compacted base (96%) Concrete – curbs, gutters, sidewalks, exterior flatwork – Minimum 6" compacted base (96%) or minimum 4-3/4" crushed gravel.

Untreated Base Course	
Size	% by Weight Paving Sieve
1"	100
½"	70 to 100
#4	41 to 68
#16	21 to 41
#50	10 to 27
#200	4 to 13

Surface course (asphalt) aggregate:

Surface Course (asphalt)	
Size	% by Weight Paving Sieve
½%	100
3/8"	70 to 100
#4	50 to 78
#16	30 to 48
#50	18 to 31
#200	7 to 13

Base course (lower lift) can be ¾" asphalt if placed in more than 1 lift.

Construct asphalt paving only when atmospheric temperature is above 50 degree F and underlying base is from moisture. Permit no vehicular traffic for at least 24 hours after laying asphalt pavements.

Striping paint: State of Utah #780. Spread at the rate of 103-113 sf/gal. Minimum thickness shall be 7 dry mil.

Tack coat all adjoining materials, i.e. previously constructed asphalt, concrete, etc. except untreated base course.

Surface smoothness: variation in the finished surface must not exceed 1/8" in 10 ft. in any direction.

Asphalt shall comply with Marshall Design with voids 1.5% to 3.0%

Drainage: Slope all asphalt concrete paving surfaces for positive drainage a minimum of 1.5% and preferable 2%.

Minimum thickness for parking areas: 3". Minimum thickness for road areas and truck traffic is 3" including dumpster access.

Maximum thickness for lifts: 3"

3.3 ARCHITECTURAL

A. Suspended Ceiling Systems

Brief Description of the Problem

In as much as the IBC requires that suspended ceiling comply with the requirements of section 9.6.2.6 of ASCE 7 for installation in high seismic areas, the code section has 3 requirements which have been problematic in application:

1) The width of the perimeter supporting closure angle must be not less than 2 inches and the grid must have a ¾" clearance from the wall. This requirement has created an aesthetic nightmare for architects and contractors since the 2" angle brings out all irregularities on the plane of the wall and requires increased inspection time to ensure a ¾" clearance.

2) Except where rigid braces are used to limit lateral deflection, sprinkler heads and other penetrations shall have a 2 inch oversize ring, sleeve, or adapter through the ceiling tile to allow for free movement of at least one inch in all horizontal directions. Alternately, a swing joint is permitted to accomplish the same movement. The issues with this requirement is that the Fire Marshall and the fire protection community will not approve

any oversize rings, sleeves or adapters which are not listed for this use and currently there are not listed systems on the market. The use of the swing joint is not defined in the code and no one has been able to establish how many joints are necessary to accomplish the horizontal movement of one inch in all directions.

3) Special inspection is required for suspended ceilings. This requirement is once again a problem since the ICC does not have a certification system for a ceiling inspector and we end up using a regular code inspector.

IBC section 104.11 allows the Building Official to approve alternate designs or methods of construction which he feels are equivalent or meet the intent of the current code. Uniform Building code Standard 25-2 for metal suspension systems for acoustical tile and for lay-in panel ceilings that can be found in the 1997 edition of the UBC is an equivalent standard that has been used in the codes for many years. This standard offers protection in all the seismic areas in the state and does eliminate all three of the issues identified above.

The State of Utah will allow the use of the 1997 UBC Standard 25-2 as an alternate means for the installation of suspended ceilings. This standard should remain available until all the issues identified above have been addressed by ICC and the listed materials are available in the market place. The designers may still use the current code requirements found in the 2003 IBC if they can show that they have met the intent of the current code.

B. Daylight and Outside Views

Design Requirements

Daylight and outside views are desirable for all occupied spaces. The needs of some occupied spaces may require special consideration for light control.

C. New Roofing Requirements

Design Requirements

Comply with Contractor Roofing Warranty: Include DFCM requirements. Refer to http://dfcm.utah.gov/rphm/5yr_warranty.pdf

Comply with Guaranty for Bituminous Roofing: Include DFCM requirements. Refer to http://dfcm.utah.gov/rphm/bur_warranty.pdf

Comply with Guaranty for Single-Ply Roofing: Include DFCM requirements. Refer to http://dfcm.utah.gov/rphm/singleply_warranty.pdf

Comply with the list of DFCM approved manufacturers and approved installers. Refer to http://dfcm.utah.gov/rphm/manufacturers.pdf

Where manufacturer's standards show one or more possible approach for compliance to the standard, provide their most stringent approach.

Eliminate conflict between roof penetrations (i.e. vents, exhausts) and roof crickets, flashing, and valleys. Consider relocating penetrations to less visible areas. Provide 18" access for replacing roofing components.

In new facilities, build slope into roof structure in lieu of built-up insulation to solve roof drainage issues.

Minimum slope for all roofing and waterproofing systems shall be a ¼" per foot along the longest drainage path.

Do not provide the following components, unless approved by the Director:

Other Roofing Components: ballasted roofs.

All roofing systems and components should meet or exceed all ASTM, UL and FM requirements.

Minimum 60 mil thickness required for all single ply roofs.

Minimum 4-ply, type VI felts with type III asphalt for all built-up roofs.

All metal associated with the roof should be color clad, use standing seam joints where possible. Follow SMACNA guidelines for all metal work.

Provide reasonable access to all roof levels for maintenance personnel.

Steep slope roofing should be designed as directed by the DCM Program Manager.

Comply with all other minimum standards as published by the DFCM roofing group.

D. Replacement Roofing Requirements

Design Requirements

Comply with Design Requirements Record Roofing Requirements.

Existing Roof System Components: For existing roofs, evaluate the feasibility of using existing insulation, sheet metal and other existing roof system components if they are in like new condition and will not have a deleterious effect on the new roof system.

Roof Slope: Each existing facility project shall be evaluated to determine existing roof slope and if additional slope is required to eliminate ponding.

Roof Diaphragm: Evaluate the existing roof to determine whether the diaphragm needs to be upgraded to meet current seismic requirements. Report shall include: 1) Existing conditions related to current requirements; 2) Recommendations for upgrading the diaphragm relative to an upgrade of the facility; 3) Estimated costs for upgrading the diaphragm.

Roof Load Evaluation: Evaluate the existing roof deck structure to determine the existing dead and live load capacity. The weight of the entire roof system shall not exceed an amount that would reduce the live load capacity of the roof structure below the current requirements. Report shall include: The existing conditions relative to current requirements; 2) Recommendations for upgrading the load capacity, relative to an upgrade of the facility; 3) Estimated costs for upgrading the structure.

Vapor Retarder: Determine the need for vapor retarder based on dew point calculations, facility use, and existing facility and roofing system conditions.

E. Waterproofing and Sealants

Design Requirements

Warranty: For sealant systems, guarantee both labor and materials for a minimum of two years. For waterproofing project, guarantee both labor and materials for a minimum five years.

Qualifications: For Dampproofing and Waterproofing, select products that have performed successfully for a minimum 15 years and select manufacturers that have been producing materials for 15 years.

F. Acoustical Quality

Design Requirements

When possible, design spaces in accordance with following minimum requirements for "Privacy."

Privacy	
Space Category	Measured NIC Rating
Confidential with high voice levels	58-60+
Confidential with slightly raised voice levels	52-58
Confidential with normal voice levels	50-52
Confidential with lowered voice levels	45-50

Design spaces in accordance with the following minimum requirements for "Ambient Background Noise.

Ambient Background Noise	
Space Category	Measured NC Rating
Critical Performing Spaces	<20
Performing Spaces, Courtrooms, Executive Offices	20-30

Sleeping, testing, or relaxing spaces	25-35
Private offices, small conference rooms, classrooms, libraries	30 -35
Open offices, reception areas, cafeterias, gymnasiums	35-40
Lobbies, laboratories, maintenance shops	40 -45
Kitchens, industrial shops, equipment rooms	45-55

G. Guardrails

Comply with code requirements for opening size but orient the members so that a ladder effect does not occur.

3.4 STRUCTURAL

A. Concrete

Design Requirements

Warranty: Provide additional two-year written guarantee commencing on the date of substantial completion to promptly remove and/or repair defective concrete (pitting, spalling, cracking, honeycombing, etc.).

Concrete Strengths & Testing: Provide minimum compressive strength measured at 28 days of 3000 psi for foundations, stem walls, piers, miscellaneous interior walls, etc., and 4000 psi minimum for all exterior flatwork, ramps, curbs, gutters catch basins, concrete pavements, interior floor slabs, elevated slabs, shear walls and columns. DFCM allows shear wall and columns to be specified in excess of 4000 psi. Specify pre-cast concrete with a minimum strength of 5000 psi.

Cement Types: Comply with the recommendations of the Geotechnical report. DFCM requires one of these types: Type I or Type II (both low alkali) and Type V. In southern Utah, usually select Type V. In other parts of the state select Type I or Type II (low alkali).

Concrete Mix: Provide low alkali cement for all concrete in direct contact with earth. Specify water/cement rations in accordance with ACI 318. Specify number of bags of cement per/yard in accordance with C150. Provide admixtures complying with the requirements of ASTM C260 for air entrained concrete. Do not use “IA”, “IIA”, etc. For frost resistant concrete, the following minimum air contents are required for concrete in direct contact with soils or exposed to severe salting: for ¾” maximum aggregate size per C33, provide air content per ASTM C260 of 6-1/2%+ 1-1/2%; for 1”, provide 6%+ 1-1/2%; for 1-1/2”, provide 5-1/2”+1%. Water cement ratios shall be limited to 0.50. (excluding grout mixes) The slump of all concrete shall be limited to 4” unless plasticizers are used. A maximum of 10% fly ash is allowed.

Testing: DFCM shall pay for testing, unless other procedures are specified. The frequency and minimum numbers of test cylinders shall be as outlined in the IBC, however at least three test cylinders must be taken from each pour related to a structural member. The intent is to not to do

testing on concrete for items such as curb, gutter, sidewalk, mow strips, light pole bases, etc.

Reinforcement: Reinforce all concrete with conventional rebar or welded wire fabric. Slabs on grade supporting less than 400 psf uniform loads and no rack loads may be un-reinforced. The sub-base for all un-reinforced slabs must be uniformly compacted with on-site observation and per requirements specified in the project specifications.

3.5 MECHANICAL

A. Controllability of Systems

Design Requirements

Maintaining space comfort temperature is an important consideration in the design of the mechanical system along with the proper ventilation within each space. This is accomplished best by the proper zoning of the space with regards to the mechanical system installed and the ability to control the temperature within each zone. The zoning for control of the space temperature shall be such that corner spaces having multiple exposures, office spaces for directors, managers, or other such individuals, and conference rooms larger than 200 square feet, shall have individual space control. Other multiple spaces shall be zoned with these spaces of like size, occupancy, and exposures are one zone and do not exceed more than four spaces per zone. Open spaces, such as open offices, shall not exceed one zone per every 750 square feet. Individual classroom spaces may be zone as a single zone even if the space exceeds 750 square feet with consideration for noise and air distribution (some large classroom spaces may need more than one zone for temperature control). Laboratory space zoning will be matched to the exhaust requirements for the labs and size of the laboratory space.

B. Indoor Air Quality

Design Requirements

Comply with ASHRAE 62.1-2004 and all approved addenda for Indoor Air Quality performance.

Comply with the carbon dioxide differentials for all types of occupancy are accordance with ASHRAE 62-2001, Appendix D.

C. Plumbing General Requirements

Design Requirements

Insulation: Completely insulate the following systems: all domestic cold water piping above ceiling; all domestic hot water piping and recirculation lines; roof drain and overflow piping including horizontal piping above ceilings, vertical piping below roof drain bowl, and roof drain

bowls. Provide protective covering for exposed insulation in areas subjected to damage.

Exterior piping insulation: Cover all insulation with aluminum jackets secured with aluminum bands 12 inches o.c. Seal joints watertight.

Main plumbing connections: Locate main water, and sewer connections and mechanical rooms on the same side of site as service, preferably close to maximum demand points such as core toilet stack, kitchens, boiler room, and fire protection systems.

Piping installation: Install piping overhead wherever possible. Avoid installing piping below or in concrete slab floors. Install piping on warm side of building insulation. Provide water-tight sleeve and caulking around pipe for all piping passing through floors.

Exposed pipe: comply with ASTM 53.

Underground pipe: comply with ASTM A106.

Roof drains: provide minimum 3 inch roof drains.

Equipment Pads: Provide minimum 4" high concrete bases for all pumps, air compressors, boilers, chillers, and other equipment.

Valves: Install valves with bonnets at least 45 degrees above the horizontal to ensure debris does not collect in bonnet.

D. Water System

Design Requirements

Municipal Water Meter: Each facility shall have a compound water meter installed in the water line serving the facility in accordance with local water authority.

Campus Water Meters. Install meter in the main mechanical room or within easy access of mechanical spaces. If conditions do not permit inside installation, provide meter box outside. Where fire sprinklers are installed, the fire main shall be connected ahead of the meter. Where outside meters are used, the meter box shall be 52" x 81" x 71" high with a concrete base under the meter, but the rest of the floor shall be gravel. Top shall have recessed eyes. Top to be poured separate so it can be moved off with a crane and the eyes shall be left large enough to insert a chain by which can be lifted. Cover to have a 24 inch locking meter lid in center. Position meter so it can be read without personnel entering the vault. Water meter indicator shall be the totalize type reading directly in gallons of water. Water meter shall be installed with valves on both sides so meter can be removed and a bypass line installed. Sleeve around pipes passing through walls of meter box.

Domestic Water Pressure shall be maintained at a reasonable operating pressure, i.e., 50 – 80 psig.

Valves: Provide valves near the main with a union for all branch lines of water which supply more than one outlet or unit so areas of the building may be shut down for repair without having to shut down large areas. Provide isolation valves as necessary and provide, as a minimum, valves for each toilet group outside of the toilet room, each floor, and each branch line that is 2" or greater Provide a shutoff valve on all water supply lines on the room side of the fixture. Valves shall have a gasket seat, not a ground joint. Supply lines from the valve shall be 3/8" brass, chrome plated. Provide chases or access panels to access valves. In lieu of oversized globe valves, ball valves with full opening ports and adequate pressure and temperature rating may be provided up to two inches in size. For valves greater than two inches in size, butterfly valves with wheel and gear operator may be used.

Water relief valves: Connect water relief valve exhaust or discharge to nearby floor drain. Provide sump in pipe tunnels at each cleanout. Provide floor drains in toilet and utility rooms.

Faucets and hose bibs: Provide non-freeze type hose bibs with shut-off valves for the lines serving the hose bib located inside facility. Provide faucet with hose attachment and vacuum breaker in each restroom so floor can be washed with clean water. Provide hose bib with vacuum breaker in mechanical rooms and chiller rooms. Provide non-freeze hose bib with vacuum breaker near cooling tower. Provide hose bibs outside building for window washing, walk and area way washdown (generally not more than 150' on center).

Inaccessible Water Piping: Provide Duiron cast iron pipe, PVC "Blue Brute", or copper up to 2 inches in size, for water lines under building slab or other inaccessible locations.

Soil cover for outside services greater than 6000 HDD: Provide minimum cover of 48" or preferred cover of 60" for water. In no instance shall the minimum depth be less than the frost line.

Soil cover for outside services less than 6000 HDD: Provide minimum cover of 36" or preferred cover of 48" for water.

E. Waste System

Design Requirements

Pipe Tunnel Sumps: Provide sump in pipe tunnels at each cleanout. Sump shall be three foot square and four feet deep with grating cover and porous walls. Floor drains may be used in lieu of sump if depth of waste line is such that drains may be tied in.

Drains: Provide drains indirectly connected to building drainage system for walk-in refrigerators and other places where food is stored. Provide floor drains in toilet and utility rooms. Provide deep seal P-traps on all floor drains.

Equipment Room Floor Drains: Trenches with grating covers with bottoms sloped to drain are preferred over multi-floor drains in mechanical equipment rooms and some laboratories.

Water still drains: Provide Kimax glass to nearest main drain from water still drains or provide glass pipe for the first 20 feet horizontally or to the floor below. Provide cleanout at water still and at main drain line before glass is connected with soil piping

Waterproofing pans: Provide membrane ~~or lead~~ waterproofing pans for shower stalls and custodial floor sinks so they are 100% water tight. Provide clamping device which clamps drain to pans. Provide a mastic seal between floor drain bottom and lead or membrane so when clamping device is tightened there is a complete seal so no water can get through. Do not clog weep holes. Test pans by placing test plug in drain and filling with water overnight.

Dishwasher connections: Provide indirect connection for waste on automatic dishwashing machines. Install minimum 3" drain so that it is accessible under conveyor table.

Cleanouts: Provide cleanouts at base of each vertical rise, each turn in excess of 45 degrees ~~inches~~ and on straight runs every 50 feet.

Horizontal Waste lines: Provide dedicated minimum 3" horizontal waste lines with adequate cleanouts for garbage disposals and dishwashers.

Roof drains: Roof drain piping shall not be less than 3 inches.

Flush valves: Provide screwdriver stop valves on flush valves for water closets and urinals. Provide exposed type flush valves.

F. Plumbing Fixtures and Equipment

Design Requirements

Water Heaters: Coordinate installation so that nothing will interfere with the removal of water heaters or for heating coils in heat exchangers to allow for periodic cleaning. Provide unions for all connecting piping to facilitate the removal of piping. Provide combination temperature and pressure relief valve piped to adequate drain. Where feasible install flexible connections and tie-down straps to accommodate movement during seismic events.

Toilet Room Fixtures: Provide exposed type flush valves with lever operator (no push buttons or floor operators), diaphragm type only. In restrooms subject to vandalism, provide concealed flush valves. If space and budget allows, flush valves may be concealed in other applications. Hands free sensor actuated valves are acceptable, if acceptable by the Agency. Provide fixtures manufactured by one manufacturer.

Showers: Provide non-scald type shower valve with integral stops. Provide institutional type shower heads with flow adjustment and adjustable head and spray. Extend head out from wall so water does not run down wall when valve is turned off. Heads shall be vandal proof. Provide watertight shower escutcheon with weep hole in bottom.

Waterproofing pans: Provide membrane or lead waterproofing pans for shower stalls and custodial floor sinks so they are 100% water tight. Provide clamping device which clamps drain to pans. Provide a mastic seal between floor drain bottom and lead or membrane so when clamping device is tightened there is a complete seal so no water can get through. Do not clog weep holes. Test pans by placing test plug in drain and filling with water overnight.

Drinking Fountains: Provide refrigerated type, wall hung drinking fountains with stainless basins. Provide removable grid strainer to enable cable-style cleaning without having to dismantle the fountain.

Do not specify the following components, unless approved by the Director:

Toilet Room Fixtures: Tank type

G. HVAC General

Design Requirements

Heating systems: Hot water systems are the preferred heating systems. Provide air separators and expansion tanks for all hot water heating systems regardless of piping arrangement. Tie air separators into piping system on suction side of circulating pump. If campus system hot water system is turned off during the summer, provide alternate heating system for equipment requiring a heating source.

HVAC: Locate mechanical rooms to take advantage of ductwork and piping proximities to major loads. Provide continuous cooling for telecommunication and main telecommunication room. Carefully coordinate the location of any exhaust or relief air with mechanical air intake systems to avoid short cycling. Provide dedicated relief air path for all systems which introduce outside air. Exfiltration through the building envelope does not comply with this requirement.

Redundancy: Provide for continuous operation through redundancy and/or modularization for facilities greater than 30,000 sf or which have critical functions or critical care residents. The loss of one half or less of the design cooling or heating system for the entire facility shall be tolerated temporarily in the event of equipment failure for: heat pumps, boilers, refrigeration machinery (excluding cooling towers), and condensate pumps.

Access: Provide stair access to equipment. Provide disassembly access for all valves, piping, and equipment.

Water Treatment: Provide water treatment for heating water systems, chilled water systems, condenser water systems, and steam systems. Provide for one year on site service by water treatment company including supply of chemicals. Provide treated water in the heating system until facility is accepted by DFCM.

H. Air Distribution

Design Requirements

Filtration: Air handling equipment shall be fitted with filters in the medium efficiency category having and average efficiency of 25% to 35% based on MERV rating criteria. Specify that the Contractor replace all filters prior to building occupancy and provide one replacement set of filters for the entire facility. For air handlers exceeding 10,000 cfm, provide pressure differential instrumentation across the filter bank to facilitate maintenance.

Ductwork Materials: Provide rectangular and round ductwork from galvanized steel, stainless steel or aluminum. Leakage requirements shall meet or exceed SMACNA standards.

Volume Adjusting Devices: Provide devices that can be securely locking in place and that are accessible for adjustment after construction.

Do not provide the following components, unless approved by the Director:

Duct Lining: lining of outside air ducts, lining of ductwork within 10 feet downstream of any device that adds moisture to the air stream, line of ductwork exposed to humid air stream above 70% RH such as swimming pool applications.

Ductwork: Fiberboard ductwork.

I. Piping System

Design Requirements

Piping Systems: Piping system shall be provided with manual air vent valves at system high points and drain valves at system low points. Suitable provisions, such as access panels, shall be furnished in building construction to permit full access to these valves. Manual air vents shall be 3/8" globe valves with ¼" copper tubing to near floor or to locations where water may be caught in bucket. Drain valves shall be threaded for ¾" hose connections. Provide water-tight sleeve and caulking around pipe for all piping passing through floors.

Pumps: Provide pressure gauge with gauge cocks as close to pump suction and discharge as possible and avoid pressure drops across valves, strainer, flexible connectors, etc. Provide suitable throttling valves on discharge side of all pumps, such as globe valves,-or balancing cocks. Throttling valve shall have set point position indicator and shall not be used for shut-off valve.

Exposed pipe: comply with ASTM 53.

Underground pipe: comply with ASTM A106.

Air Vents: Provide suitable air vents for all heat producing equipment (converters, unit heaters, coils, etc.).

Valves: Provide valves near the main with a union for all branch lines of water or steam which supply more than one outlet or unit so areas of the building may be shut down for repair without having to shut down large areas. For valves 2" and larger on systems greater than 200 degrees F shall be flanged or grooved.

J. Steam

Design Requirements

Motor Operated Steam Valve: If the existing central plant serving the campus is a steam system, provide a motor operated steam valve for each new building. Coordinate location with the Agency. If equipment requires steam when the valve may be closed, connect equipment ahead of motor operated steam valve. Design for gravity flow of condensate in lieu of providing vacuum pumps. Provide tunnels, chases, access doors, or crawl spaces for accessing steam piping. Do not install underground or in split tile. Provide properly dripped steam mains. Provide drip legs ahead of all steam pressure reducing valves and steam coils to ensure clean, dry steam at the valve.

Valves: Low pressure steam valves shall have a 200 psi rating and allow renewable seats and discs. For 100 psi steam line use 25 psi flanges and 300 psi screwed valves. Provide valves near the main with a union for all branch lines of steam which supply more than one outlet or unit so areas of the building may be shut down for repair without having to shut down large areas.

Steam piping: For steam piping 2" and smaller, provide schedule 80 black steel. For sizes 2-1/2" or larger, provide schedule 40 black steel for low pressure steam (15 psig or less) and schedule 80 black steel for high pressure steam (higher than 15 psig). Provide low pressure steam valves with a 200 psi rating and allow renewable seats and discs. Provide 250 psi flanges and 300 psi screwed valves for 100 psi steam lines.

Condensate piping: Provide schedule 80 black steel pipe, including underground return lines.

Underground steam lines: Provide Gilsulate, Ric-wil, Portage and Durrant insulated underground pipe for underground steam lines. If pre-insulated piping is used, provide separate insulated conduits for steam and condensate return piping.

Expansion Provisions: Provide expansion loops, swing joints, offsets, etc., for expansion of piping. Do not use expansion joints except when expansion loops, offsets, swing joints, etc., are possible due to space constraints. If expansion joints are provided, provide adequate internal or external guides that are properly supported anchored. Do not provide swing joints on main runs; however, swing joints may be installed on risers off the main.

Pressure reducing stations: Provide pilot-operated valve for pressure reducing stations. Provide a three-valve by-pass at all reducing stations with ample clearance to permit normal maintenance and inspection. Recommend parallel pressure reducing stations when low demand is expected. Provide safety relief valves on the low pressure side of regulator stations. Provide discharge

piping to facility exterior in a safe location. For pipes discharging near grade, install pipes into an eight inch concrete tie set upright in the ground (buried) over a gravel base twelve inches deep. Provide pressure gauges on both the high pressure and low pressure sides of all regulator stations. Locate gauges so they will function when bypass is used.

Steam Meter: Provide totalizing type meter which reads directly in pounds of steam.

Miscellaneous Requirements: Provide eccentric reducers when steam piping changes pipe sizes. Provide water-tight sleeve and caulking around pipe for all piping passing through floors.

K. Natural Gas

Design Requirements

Seismic gas shut off valve: Provide a seismic gas shut off valve installed per manufacturer's instructions for each natural gas system.

Natural Gas Piping: Weld all concealed natural gas piping if larger than 4". Where feasible install flexible connections and tie-down straps to accommodate movement during seismic events.

Soil cover for outside services greater than 6000 HDD: Provide minimum cover of 24" or preferred cover of 36" for gas.

Soil cover for outside services less than 6000 HDD: Provide minimum cover of 24" or preferred cover of 36" for gas.

L. HVAC Equipment

Design Requirements

Boilers: Provide boiler backup by redundancy or modularization. If a power burner is specified, the A/E shall determine the maximum allowable length of positive pressure flue.

Unit Heaters: If a unit heater is higher than 10' AFF, a centrifugal blower shall be provided and not a propeller fan. Provide all gas or oil unit heater with a 2-stage thermostat. On call for heat, the stage cycles the fan. The second stage fires the burner. For shop applications with heavy duty or corrosive atmospheres, provide sealed combustion units that bring combustion air from outside the space.

Water Chillers: Specify appropriate ARI Standards and certification.

Cooling Towers: Specify certification by the Cooling Technology Institute.

Converters: Provide side inlets and side outlets for all converters. Provide pressure gauges with snubbers on the primary and secondary side of each converter. Install thermometers on the inlet and outlet of the secondary side of each converter.

Do not provide the following components, unless approved by the Director:

HVAC Equipment: electric resistance heat, furnaces.

M. Integrated Automation

Design Requirements

Direct Digital Control: Provide direct digital control in all facilities, except where operations personnel require pneumatic control as an extension of an existing system. Provide digital metering of electrical, hot water, steam, and chilled water sources to each facility. Provide flow metering devices hot water heating systems. Provide straightforward DDC control systems. Avoid locating thermostats on outside walls or on partitions between offices. For perimeter radiant systems, provide Hydronic piping subcircuits to match the cooling zones.

Control valves: Provide visual position indicators. Provide control valves with stem in the vertical position. If possible, provide packless valves. Do not provide "self-contained" valves.

Dampers: Provide low leakage design of felt or neoprene edges for fresh air and exhaust air dampers. Provide opposed blade type modulating dampers with maximum blade width of eight inches. Provide fresh air dampers that close in fan shutdown or power failure. Provide steel trunnions mounted in bronze sleeve bearing or ball bearings for damper blades. Do not exceed 48 inches in length between damper bearings. Provide dampers that close substantially tight and provide substantially the full area of the opening when open. Provide substantial bar or channel frames for dampers. For rectangular dampers larger than four square feet in area, provide additional corner bracing.

Thermostats: If system supports DDC monitoring, provide solid state thermostats. Thermostats in corridors, halls, restrooms and other similar unsupervised areas shall be flush mounted aspirating type with stainless steel cover. Thermostats in public, but supervised areas shall have locking covers with concealed adjustment. Thermostats in private offices may have exposed adjustments.

Panels: Provide control devices, relays, piping, wiring and terminals in cabinets, except that switches, pilot lights, and push buttons mounted on the door. Provide minimum 14 gauge steel or 12 gauge aluminum. Equip doors with hinges, latches, and locks. Secure panels to walls, columns or floors with clearances required by NEC. Provide two (2) keys for each panel.

Wall Mounted Control Diagrams: Provide plastic laminated copies of all applicable controls diagrams mounted on the wall in each equipment room.

Control wiring: Provide control wiring in raceway complying with the requirements of DIV 16, except that ½" C may be installed for control wiring of less than 50 volts which complies with NEC conduit fill requirements.

N. Automatic Sprinkler Systems

Design Requirements

Provide an automatic sprinkler system in buildings when required by the building codes adopted by the State of Utah.

It is desirable that all buildings constructed by the State of Utah be equipped with an automatic sprinkler system to provide added life safety for the occupants and to protect the building from fire loss.

Fire sprinklers shall be considered as an integral component of building design when the availability of water supply and the cost do not make the installation prohibitive.

Secondary structures and small buildings or buildings with low occupant loads may be excluded from this requirement with the approval of the Director.

3.6 ELECTRICAL

A. Emergency Electrical Requirements

Design Requirements

Modify paragraph 700.12 General Requirements of the NEC to:

"Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds. The supply system for emergency purposes for buildings totaling less than 5000 sf, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in 700.12 (A) through 7001.12 (E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article for buildings totaling less than 5000 sf. The supply system for emergency purposes for buildings totaling 5000 sf or greater, in addition to the normal services to the building and meeting the general requirements of this section, shall be the type of system described by 700.12 (B). This requirement shall not prohibit the use of the supply systems 700.12 (A), or 700.12 (C) through (F), for buildings totaling 5000 sf or greater, if these systems are required for safety purposes and if these systems are automatically connected to a Generator Set as described in 700.12 (B)." [The balance of section 700 is unchanged.]

Modify paragraph 701.11 Legally Required Standby Systems of the NEC to:

"Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, legally required standby power will be available within the time required for the application but not to exceed 20 seconds. The supply system for legally required standby purposes for buildings totaling less than 5000 sf, in addition to the normal services to the building shall be permitted to comprise one or more of the types of systems described in 701.11(A) through 701.11 (F). Unit equipment in accordance with 701.11(G) shall satisfy the applicable requirements of this article for buildings totaling less than 5000 sf. The supply system for legally required standby purposes for buildings totaling 5000 sf or greater, in addition to the normal services to the building shall be required to be the type of system described by 701.11 (B). This requirement shall not prohibit the use of the supply systems 701.11 (A), or 701.11 (C) through (G), for buildings totaling 5000 sf or greater if these systems are required for safety purposes and if these systems are automatically connected to a Generator Set as described in 701.11 (B)." [The balance of this section is unchanged.]

The Director of DFCM may authorize battery packs in suitable applications when the standard is not achievable due to the unique circumstances of a particular project or the constraints of the project budget.

B. Lighting

Design Requirements

Occupants within an enclosed space shall have the capability to adjust the lighting within the enclosed space.

Light Pollution Reduction: Comply with Light Pollution Reduction requirements, unless otherwise directed by the DFCM's Designated Representative.

Comply with the Illuminating Engineering Society of North America (IESNA) Recommended Practice Manual: "Lighting for Exterior Environments (RP-33-99)." Provide exterior luminaires which are shielded. For luminaires with more than 3000 initial lamp lumens, provide Full Cutoff (IESNA Classification) luminaires. Interior lighting shall be positioned so that the maximum candela value does not fall outside the interior space, such as out through a window. Exterior lighting shall be located so that the maximum candela value of all exterior lighting shall fall within the property. Provide shielding for any luminaire within a distance of 2.25 times its mounting height from the property boundary so that no light from the luminaire illuminates past the property boundary.

Lighting Fixtures. Provide lenses that will not yellow due to exposure to sunlight or to the light sources in the fixture. When acrylic diffusers are specified, provide 100% virgin acrylic. Provide electronic ballasts, except that magnetic ballasts may be used in outdoor applications. Provide program start ballasts, if available for the lamp type. Connect equipment grounding conductor to fixture housing. Provide a 10% spare lamps, diffusers or glass for each light fixture type with not less than one for less than 10.

Interior Lighting: Provide T-8 lamps in fixtures, except for areas requiring special lighting. Provide independent safety-wires attached to structure at two diagonal corners of lighting fixtures in compliance with seismic requirements. For recessed fluorescent fixtures that are removable, locate outlet box with 3' of steel flexible conduit to the fixture to aid in removing and relocating fixture.

Exterior Lighting: Provide -10 degree F. ballasts, either constant wattage or pulse start. Provide break-away fuse for all phase conductors for all outside pole mounted lighting fixtures. Provide a shorting fuse insert for neutral fuse holder. Do not use common neutral multi-wire circuits for this type of lighting.

Reflected Ceiling Plan Coordination: Coordinate the lighting fixture with the reflected ceiling plan for lay-in and surface mounted fixtures. Recessed lighting fixtures in acoustical tile ceiling shall be located centered on a single tile or at the intersection of four tiles.

Lighting Fixture Supports: Provide swivel bases for stems supporting lighting fixture which exceed 12" in length.

HID Sources: Provide Constant Wattage ballasts. For metal halide, provide Pulse Start Metal Halide lamps and ballasts. For indoor, provide pulse start electronic ballasts. For outdoor up to 200 watts, provide pulse start electronic ballasts. For outdoor above 200 watts, provide magnetic ballasts if control, noise, and flicker requirements are satisfied.

C. Raceways to 600 V

Design Requirements

Raceways, Fittings, and Boxes. Provide steel raceway, fitting, and box system for all wiring, except that plastic conduit (minimum schedule 40) may be installed underground and aluminum cable trays may be installed for communications cabling. For steel raceway installed in contact with soil, provide rigid or IMC PVC coated or wrapped raceways, fittings, etc. Provide steel raceways for penetrating structural elements (minimum 10' each side) and rigid steel conduit (PVC coated or wrapped) for bends greater than 22 degrees. Provide minimum ¾" raceways, except ½" may be provided for HVAC Instrumentation and Control. For Communications raceway, the bend must be a minimum 6 times the diameter for sizes 2" or less and 10 times the diameter for larger then 2". Provide flexible steel conduit (minimum ½") in short lengths where movement, vibration, misalignment or cramped quarters exist. Provide insulated throat or equal type plastic bushings for box connection 1" or larger. Provide double lock nuts and plastic bushings for IMC and rigid conduit. Provide liquid-tight flexible conduit with approved moisture-tight fittings for wet, humid, corrosive or oily locations. Provide a minimum 18" liquid-tight flexible conduit at each motor. Provide minimum 4/s box 1-1/2" deep with plaster rings, except provide 3-1/2" deep masonry boxes for masonry. For boxes with 3 or more raceway entrances, provide minimum 2-1/8" box. For boxes with 4 or more raceway entrances, provide 4-11/16" boxes (except for masonry boxes). Provide gang boxes for multiple gang installations. Provide accessible junction boxes in interior raceway runs at minimum 100 foot intervals. Provide minimum 12" clearance from hot water and steam lines measured from outside of

insulation.

Electrical Supports. All raceways, boxes, and conductors shall be supported independently from all other electrical or mechanical systems, directly from building structure by a listed supporting device. Provide bracing parallel to trusses, beams, joist, bridging, etc. Provide anchors capable of supporting 4 times the weight of the unit supported, but not less than 100 lbs. For ceiling fixture outlet boxes, provide minimum supporting capacity of 200 lbs and a standard 3/8" stud. Provide outlet boxes with rigid support using metal bar hangers between studs. Provide concrete pads 6 inches beyond the largest dimension of the equipment. Extend equipment pad a minimum of 4" above finished floor or grade.

Steel Raceway Supports. Provide minimum of 2 supports per ten foot length; Support within 12 inches of bends, couplings, fittings and boxes, minimum of two straps per ten foot length. For 2 runs or less of ¾" to 1-1/4" raceways, provide supports with full straps, clamps or hangers. For individual run 1-1/2" or larger raceways, provide supports with hangers. All other raceways, support with trapeze mounting channels.

Future Raceways: Provide five capped spare ¾" conduits from each section of a branch panelboard into the ceiling and floor space. If the floor space is not accessible, provide an additional ¾" conduit from each section of a branch panelboard into the ceiling. Provide 200-lb nylon pull cord in all empty conduit, then cap raceway using a blank cover similar to adjacent wiring device covers.

Underground Raceway Identification and Installation: Provide direct buried conduit in an area outside a building not less 24" deep, with magnetic "yellow warning" ribbon 12" directly above and 6" below finished grade measured from the top of the conduit or duct bank.

Do not provide the following, unless approved by the Director:

Exposed cable wiring.

Other raceway systems: Electrical Non-metallic Tubing, aluminum conduit, die cast fittings, steel cable trays.

D. Conductors

Design Requirements

Conductors. Provide minimum #12 copper conductors with 600 V insulation (THW, THWN, THWN-2, XHHW, or XHHW-2) for all phase conductors; unless ambient conditions require an increased insulation rating. Do not parallel less than #1/0 conductors. Do not feed conductors through one section of panelboard to connect to an overcurrent device in another section of panelboard. Provide separate neutrals for all GFI circuit breakers and for the load side of feed thru GFCI outlets. Provide minimum 12" clearance from hotwater and steam lines measured from outside of insulation.

Do not provide the following, unless approved by the Director:

Exposed cable wiring.

Splices in panelboard, switchboard enclosures, or in conduit bodies.

Other cabling methods: Non-metallic sheathed cables (Romex), Metal Clad Cables, aluminum conductors.

E. Grounding

Design Requirements

Grounding. Ground all medium voltage equipment and exposed metals in the immediate area with the neutral conductor of the primary cable and with a minimum 5/8" X 10' ground rod. Provide grounding electrode system at the service entrance with, at a minimum, two of the following electrodes as defined in the NEC: metal underground water pipe, concrete-encased electrode, or ground ring. In addition, bond to other available electrodes. Provide a separate green grounding conductor enclosed with phase conductors in all raceways on the load side of the service entrance. Provide grounding bushings for all service raceways and for raceways installed in concentric/eccentric knockouts. All grounding systems shall be interconnected and/or bonded to the grounding electrode system. Upgrade as necessary existing electrical systems to comply with the NEC and these requirements.

F. Medium Voltage

Design Requirements

Medium Voltage Conductors: Provide copper conductors with copper tape shields and EPR insulation and 100% copper neutral in Medium Voltage Ductbanks; or, in utility tunnels or other areas without public access, provide armored cable or rigid conduit. Comply, as a minimum, to the installation requirements for Medium-Voltage Cable standard NECA 600-2003. Perform Hi-Pot test after terminations have been made, but before connections have been made to buses or apparatus. Perform continuity tests of all cables after entire installation and terminations have been completed. If a cable fails to perform, replace faulty cable and retest. All tests will be recorded and submitted with M & O manuals at project conclusion.

Medium Voltage Duct Banks. For interior of buildings in non-public areas, provide rigid galvanized conduit or armored cable marked with red HIGH VOLTAGE. For exterior applications or public areas, provide concrete encased duct-banks (red dye) with raceways in multiples of two and a minimum of one spare conduit (with polypropylene pull wire) per feeder. Provide rigid metal conduit for the first 10 feet of duct bank from a facility or manhole. Provide minimum 4" raceway.

Medium Voltage Transformer: A/E shall design harmonic mitigation to reduce current total harmonic distortion (based upon full load capacity of the transformer) below 5%. Provide copper or aluminum windings. Provide transformer taps and adjust voltage output to obtain the proper value. Provide primary and secondary terminations at medium voltage transformers, cable, splices, etc. necessary to complete installation. Do not use Askarel transformers.

Lightning Protection: Provide lightning (surge) arresters for medium voltage transformers and switchgear located above ground outside.

G. Controller

Design Requirements

Motor controllers: Provide NEMA rated magnetic motor controllers with thermal overload relays for each phase. Provide auxiliary contacts, HOA switches or start-stop pushbuttons as appropriate, stop and run pilot lights, and reset pushbuttons. Provide fused control transformer in the starter for 120 V control. Provide safety interlock to prevent opening enclosure with equipment or control energized.

Variable Frequency Controllers: Provide PWM variable frequency controllers suitable for the application, factory pre-wired with integral disconnect, input filter, and integral ventilation. Coordinate approved manufacturers with the Agency. Provide interface to HVAC or Building Automation System for control. For interior VFCs, size ventilation for ambient temperature of 32 degrees F. to 90 degrees F. Avoid exterior mounted VFCs; but, if required, provide ventilation for ambient temperatures from -30 degrees F. to 120 degrees F. Fault current rating shall be sized based upon the fault current analysis of the nearest upstream overcurrent device. Include factory startup and tune to optimize life of motor. Provide VFCs which operate within the following normal ranges of inputs: +/- 10% input voltage; +/- 5% input frequency; less than 7% voltage THD. Provide VFCs which operate through voltage sags of 0% voltage for 1 cycle and 60% voltage for 10 cycles. For Motors 7.5 hp and larger, provide a minimum power quality performance of 12% current THD and 3% voltage THD at filter or VFC input by providing a broadband type filter or minimum 12 pulse VFC complying with the power quality performance requirements demonstrated by standard factory published data. For Motors less than 7.5 hp, provide AC Line Reactor or DC Link Reactor. For VFC output filtering, provide output filter if drive output at motor termination exceeds pulse-withstand capability. Provide 95% efficiency minimum including filter and 95% power factor. Provide local speed control, HOA switch, remote start/stop, external safeties, run annunciation, fault annunciation, and speed reference input connection. For maintenance purposes, provide stable operation including starting, stopping and running with the motor completely disconnected; provide auto restart after a power failure; provide capability for starting into a rotating motor at any speed.

Provide a manual bypass of UFC as part of controller.

Do not provide the following components, unless approved by the Director.

Other Electrical Components: IEC motor controllers.

H. Electrical Distribution

Design Requirements

Overcurrent and Ground Fault Protection: Set overcurrent and ground fault protection based upon Fault Current Protection and Coordination Study prepared by the A/E.

Submit study with M & O manuals.

Transformers: Provide transformers with copper conductors. Provide transformer taps of 4 taps – 2.5% above normal and 2 taps – 2.5% below normal. Adjust voltage output to obtain the proper value at the main disconnect.

Metering: Provide secondary digital metering (including demand monitoring) at the main distribution panel(s) in each facility. For secondary digital metering for facilities greater than 800 Amps include harmonic monitoring and an option for building automation monitoring or other remote monitoring. Indicate multiplying factor on meter face where current transformers are used.

Utility Metering: Comply with serving utility's regulations, if applicable. Comply with utility's metering requirements. Include cost assessed by serving utility.

Switchboards and Panelboards: Provide bus hardware installed on the bus for future over-current devices of not less than 25% minimum. Provide over-current devices in the same sequence as shown on the panel schedules or one-line diagrams. Coordinate that the height of the operating handle of the over-current device does not exceed 6'6" above the floor. Identify main over-current protection devices.

Panelboards: Provide listed panelboard construction for all branch panels and circuit breaker distribution panels. For 3 phase 4 wire delta systems, connect Hi-Leg to center bus. Provide ground bus bonded to enclosure to terminate all equipment ground conductors. Include insulated ground bus for insulated ground circuits. Key all panelboards alike and provide 3 keys.

Circuit Breakers: Provide one, two or three-pole over-current devices with common handle (not field modifiable). Provide bolted connections.

Do not use the following components, unless approved by the Director:

Other Electrical Components: load centers, plug-in circuit breakers.

I. Miscellaneous Electrical

Design Requirements

Lighting Contactors: Provide NEMA rated lighting contactors with HOA.

Wiring Devices: Locate switches so as not to exceed 48" to the bottom above finished floor. Except for floor boxes, locate convenience outlets so that outlet is not less than 18" to the bottom and not greater than 48" to the top above finished floor. Coordinate heights with cabinetry and finishes. Use feed through GFCI outlets only if the outlet served is located in the same room. Convenience outlets (120 V) and switches (120/277V) shall be minimum 20A self-grounding with nylon faces and cover plates. Coordinate device colors and plates with the finishes. Provide industrial raised covers for surface switches and outlets. Arrange devices in gangs if multiple devices are located at the same location. Provide mounting strips and blank cover-plates for outlet boxes without devices. Do not connect more than eight (8) convenience outlets on each 20A circuit.

Lightning Protection: If the risk analysis performed per NFPA 780 exceeds moderate risk, provide a lightning protection system. Minimum qualifications required: LPI-certified installer, designer, and inspector. Obtain a UL Master Label for the facility.

Power Quality:

A/E shall include in the Basis of Design an evaluation of the potential harmonic risks to the electrical distribution system and the approach to mitigate the risks to transformers, neutral conductors, and other equipment.

Design TVSS for the main service of each facility with services greater than 200 A. Include a second level of TVSS for panelboards serving primarily computer or other electronic equipment.

Specify harmonic testing of each transformer (voltage and current THD) after the facility is occupied to determine effectiveness of the Power Quality approach.

Hazardous Classifications: Coordinate with Fire Marshall hazardous classifications and requirements, including class, division, and group requirements.

Generator Fuel Tank Size: Size fuel tank to comply with Code requirements and facility needs. Allowance shall be made in the capacity so that there is adequate fuel to comply with these requirements when the tank indicates that it needs to be refilled. Provide a minimum tank capacity for 24 hour continuous operation.

J. Structured Cabling

Design Requirements

Test all structured cablings systems to demonstrate compliance with TIA/EIA standards for the category of system selected. Include warranty and the test results in the Project Resource Manual.

K. Fire Alarm

Design Requirements

Provide addressable fire alarm systems. Install class "A" looped systems or as approved by Fire Marshal.

Do not use the following components, unless approved by the Director.

Other Fire Alarm Components: Zoned Fire Alarm panels, ionization smoke detectors.

L. Misc. Systems

Determine requirements for other systems such as security, cctv, etc.

3.7 LANDSCAPING

A. Irrigation Water

Design Requirements

Reduce life cycle costs by requiring the A/E to design state-owned buildings to comply with the following:

Water Allowance for Landscape Irrigation		
Type	Facility Type	Water Allowance
A	Office Buildings	.5
B	Existing campus/institution	.7
C	New campus/institution	.6
D	Recreation areas (ball fields, etc.)	.7
E	State Parks (natural areas)	.1

The annual Landscape Water Allowance shall be calculated using the following equation: Landscape Water Allowance (gal) = ET x PF x (Area/IE) X.62. Where Landscape Water Allowance is in gallons per growing season: ET = Reference Evaportranspiration in inches per growing season; PF = Plant Factor (see chart below); Area + total Irrigated Landscape Are in square feet; IE = irrigation efficiency (see chart below); .62 = conversion to gallons.

Plant Factor (PF)		
Plant Type	Plant Hydrazone	Plant Factor (PF)
Turf	3+	1.0
Non-drought tolerant trees, shrubs and ground cover	2-3	.7

Water-conserving trees, shrubs and ground cover	1-2	.5
Extra drought-tolerant trees, shrubs and ground cover	0-1	.2
Mulch areas not irrigated	0	0

Irrigation Efficiency	
Irrigation Type	Irrigation Efficiency
Bubblers	.85
Drip Emitters	.85
Stream Sprinklers in planter strips 8 feet or wider	.75
Spray Sprinklers in planter strips 8 feet or wider	.625
Spray Sprinklers in planter strips less than 8 feet wide	.4

All splices below grade are to be approved for wet locations.

Comply with the "Minimum Standards for Efficient Landscape Irrigation System Design and Installation", Current version of the Utah Irrigation Association. Refer to www.utahia.org

B. Plant and Soil

Design Requirements

Comply with the following:
Top Soil Quality Guidelines for Landscaping, refer to www.usu.edu/files/agpubs/topsoil.htm
USDA Hardiness Zones, refer to http://www.usna.usda.gov/Hardzone/index.html
TPI's "Specifications for turf grass sod materials" and "Specification for Turf grass sod transplanting" and installation in its "guideline specifications to turf grass sodding"
Utah Water-Wise Plants, refer to http://extension.usu.edu/files/gardbids/hg500.pdf, http://extension.usu.edu/files/gardbids/hg500-2.pdf, http://extension.usu.edu/files/gardbids/hg500-3.pdf

Do not use the following components, unless approved by the Director.

Other Plant Materials: Plant materials not complying with the Utah Water-Wise Plants and complying with USDA Hardiness Zones.